

# MATH 481A, FALL 2005

## PROJECT 2. THE CUBIC SPLINE INTERPOLATION

**Due November 18, 2005**

**Problem 1:** Analysis of performance of the cubic spline.

- Write a code implementing cubic spline  $S(x)$  with natural boundary conditions ( $S''(a) = S''(b) = 0$ ). Keep your programming so that you can change the function  $y = f(x)$ , the interval  $[a, b]$ , and the number of equally spaced interpolation nodes  $n$ , easily. Do the programming so that you can graph  $f(x)$ ,  $S(x)$  (one figure), and  $f(x) - S(x)$ ,  $f'(x) - S'(x)$  (another figure). (You can use Algorithm 3.4 on page 142)
- For  $y = \sin(x)$  on  $[0, 10]$  determine experimentally how many interpolation nodes are needed to approximate the function within  $10^{-5}$ .
- Use Theorem 3.13 on page 152 to estimate the number of nodes needed to interpolate  $y = \sin(x)$  on  $[0, 10]$  within  $10^{-5}$ .
- Write a report. Include results of your experiments (printed pictures or summary of calculations) with minor comments. Include justification for the estimated number of nodes. Attach the code.